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(54) Electrical switch and lock assembly

(57) A combined key operated electrical switch and locking mechanism comprising a relatively fixed body 11, 12, a rotor 23 rotatable relative to the body through a predetermined angular distance by means of a key introduced, in use, into a key operated mechanism 26 of the assembly, electrical contacts 22, 49 operable by rotation of the rotor 23 relative to the body, and a locking member 37, 38 protruding from the body. The locking member 37, 38 is movable angularly relative to the body about the axis of rotation of the rotor 23 and there is a lost motion coupling 41 between the rotor 23 and the locking member whereby the rotor can be moved through a predetermined angular distance relative to the body, and relative to the locking member 37, 38 whereafter, the locking member 37, 38 moves with the rotor 23.

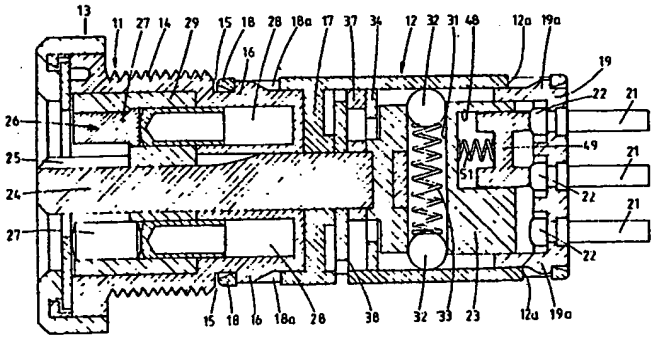

FIG.1.

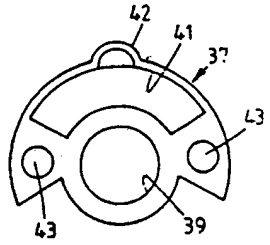

FIG.5.

The drawing(s) originally filed was (were) informal and the print here reproduced is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1982.

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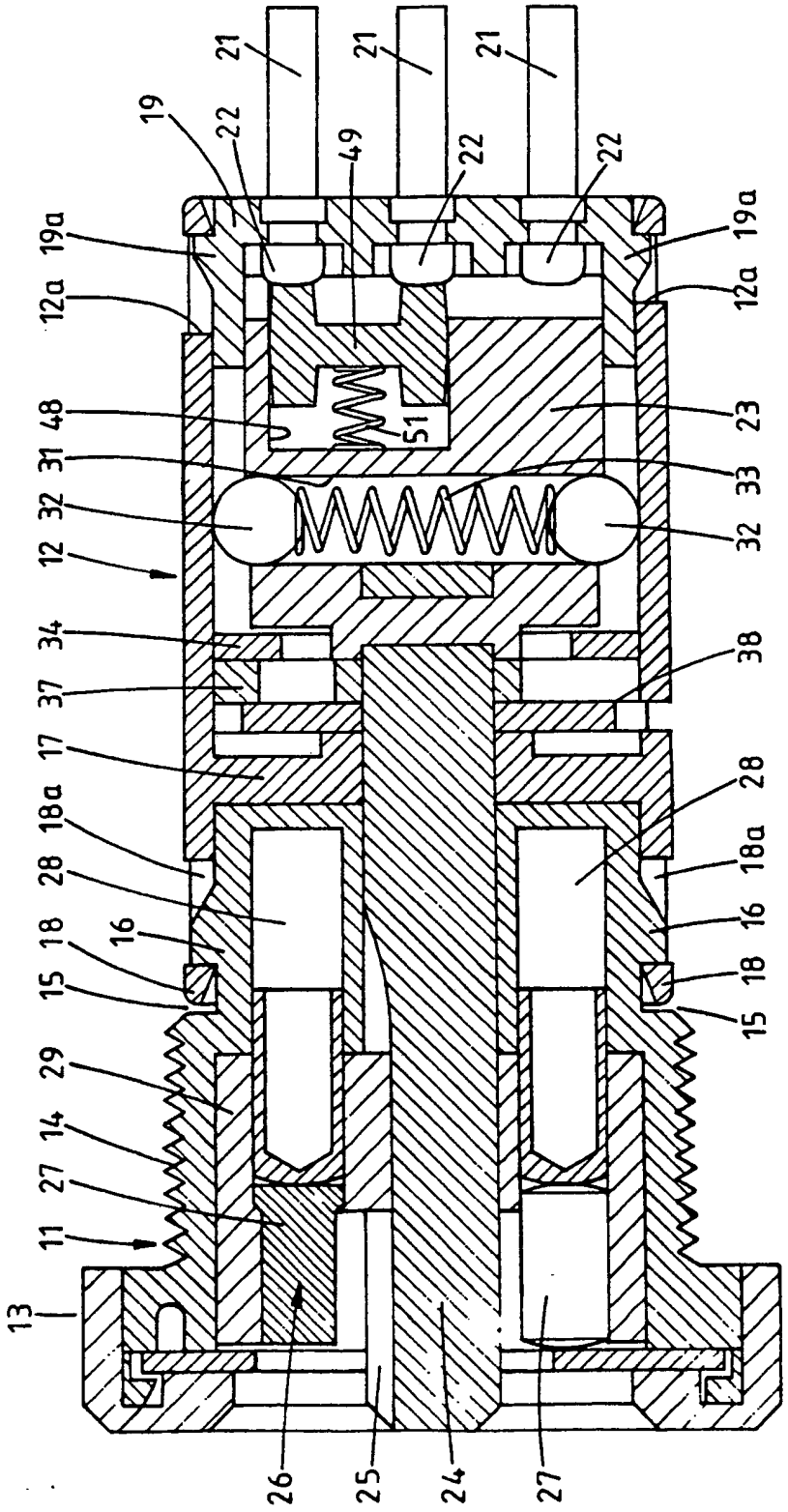

FIG. 1.

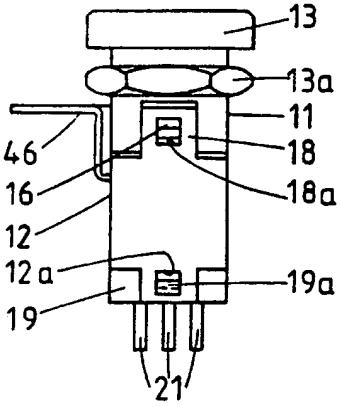

FIG.2.

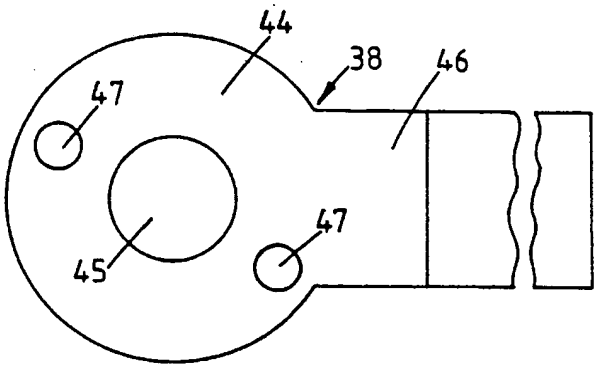

FIG.3.

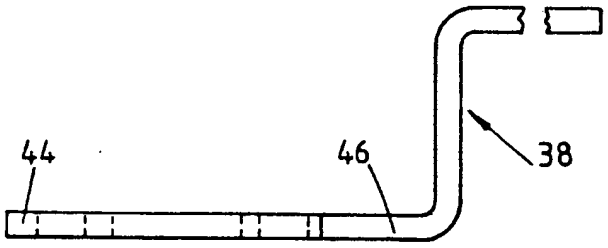

FIG.4.

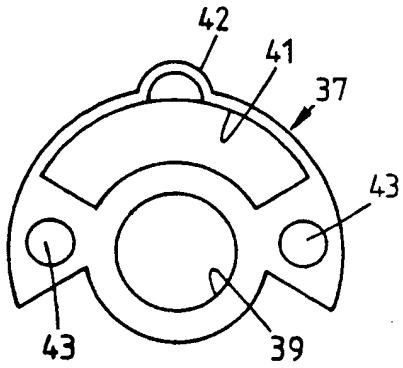

FIG.5.

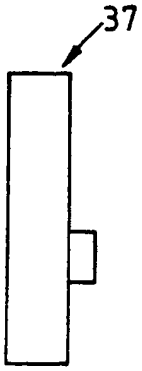

FIG.6.

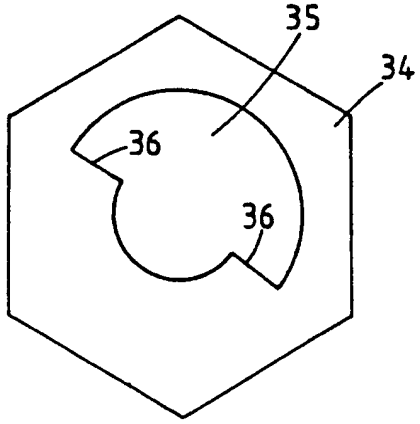

FIG.7.

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ELECTRICAL SWITCH AND LOCK ASSEMBLY

This invention relates to a key operated electrical switch in combination with a key operated locking mechanism.

It is an object of the present invention to provide, in a simple and convenient form, a combined key operated switch and lock mechanism wherein a predetermined rotation of the operating key effects an operation of the switch simultaneously with an operation of the locking mechanism.

In accordance with the present invention there is provided a combined key operated electrical switch and locking mechanism comprising a relatively fixed body, a rotor rotatable relative to the body through a predetermined angular distance by means of a key introduced, in use, into a key operated mechanism of the assembly, electrical contacts operable by rotation of the rotor relative to the body, and a locking member protruding from the body, and movable angularly relative to the body about the axis of rotation of said rotor, there being a lost motion coupling between the rotor and the locking member whereby the rotor can be moved through a predetermined angular distance relative to the body, and relative to the locking member, whereafter, the locking member moves with the rotor.

One example of the present invention is illustrated in the accompanying drawings wherein

Figure 1 is a longitudinal sectional view of a combined key operated electrical switch and locking mechanism assembly,

Figure 2 is a side elevational view, to a reduced scale, of the assembly of Figure 1,

Figures 3 and 4 are plan and side elevational views respectively of a locking member of the assembly,

Figures 5 and 6 are plan and side elevational views of a drive plate of the assembly, and

Figure 7 is a plan view of a stop plate of the assembly.

Referring to the drawings, the combined assembly includes first and second axially aligned and interconnected housing parts 11, 12. The housing part 11 is generally cylindrical, and is moulded in synthetic resin material. Adjacent one axial end the housing part 11 is formed with an outwardly extending flange 13, and adjacent the flange 13 the outer cylindrical surface of the housing part 11 is formed with a screw thread 14. At its end remote from the flange 13 the housing part 11 is formed with a pair of diametrically opposed recesses 15, the base of each recess 15 including an upstanding lug 16.

The housing part 12 is externally cylindrical, and is moulded in the same synthetic resin material as the housing part 11. Adjacent one axial end the housing part 12 is partially closed by an integral, inwardly extending, peripheral flange 17, the housing part 12 including a pair of integral, diametrically opposed, axially extending legs 18 which project beyond the flange 17. In use, when the housing parts 11, 12 are interconnected to define the relatively fixed body of the assembly, the arms 18 are received in the recesses 15, with the lugs 16 protruding through corresponding apertures 18a in the arms 18, and the end

of the housing part 11 remote from the flange 13 abutting the outer face of the flange 17 of the housing part 12. The end faces of the lugs 16 presented away from the flange 13 are inclined to define ramp surfaces whereby the arms 18 are flexed outwardly during assembly of the housing parts 11, 12, the arms 18 then flexing inwardly under their own inherent resilience when their apertures 18a align with the lugs 16. Thus the two housing parts are interengaged with a "snap" action.

Internally the housing part 12 is hexagonal in transverse cross-section, and is closed at its end remote from the flange 17 by a moulded synthetic resin base member 19 carrying electrical terminal members 21. The base member 19 is engaged as a "snap fit" in the end of the housing part 12 remote from the flange 17, the base member 19 having integral, diametrically opposed, outwardly protruding lugs 19a similar to the lugs 16, the lugs 19a being received in corresponding apertures 12a of the housing part 12. The terminal members 21 are in the form of terminal pins extending from the outer face of the base member 19 parallel to the longitudinal axis of the combined body 11, 12. The terminal pins 21 extend through the base member 19 and are integral with fixed electrical contacts 22 disposed in predetermined positions on the inner face of the base member 19.

Disposed within the housing part 12 for rotation therein is a rotor comprising a moulded synthetic resin rotor body 23 and a metal rotor shaft 24. The rotor shaft 24 and rotor body 23 are rigidly interconnected, conveniently by moulding the body 23 around one end of the shaft 24. The body 23 is received wholly within the housing part 12, and the shaft 24 extends forwardly through the central aperture defined by the flange 17,

and axially within the housing part 11. Adjacent the body 23, and particularly where it passes through the flange 17 and into the housing part 11, the shaft 24 is of circular cross-section. However, within the housing part 11 the shaft 24 is formed with an axially extending key-way 25 and thus is of non-circular cross-section.

Within the housing part 11 there is disposed a key operated mechanism for reception of an appropriate operating key whereupon the shaft 24 can be rotated. In figure 1 the key operated mechanism 26 is of the axial pin type wherein introduction of the appropriate key axially into the end of the housing part 11 remote from the housing part 12, depresses a circular row of axially extending pins 27 through predetermined distances against the action of springs 28 to free a lock barrel 29 for rotation in the housing part 11. Both the key, and the barrel 29 are in driving engagement with the shaft 24 by virtue of the key-way 25. Thus after insertion of the appropriate key the shaft 24 can be rotated by means of the key, the shaft 24 rotating about the longitudinal axis of the combined body 11, 12. It will be understood that axial pin, key-operated mechanisms of the kind depicted at 26 in Figure 1 are well known, and moreover it will further be recognised that other forms of key operated mechanism could be utilised in place of the axial pin mechanism if desired. Basically all that is required is a mechanism whereby, for security reasons, an appropriate key is needed in order to effect rotation of the shaft 24.

The rotor body 23 is formed with a diametric through bore 31 within which is received a pair of steel balls 32. The balls 32 are urged apart by a helical compression spring 33 also housed within the bore 31.

The clearance between the outer surface of the rotor body 23 and the inner surface of the housing part 12 is such that the balls 32 remain located by the bore 31 while engaging the inner surface of the housing part 12 under the action of the spring 33. As mentioned previously the interior of the housing part 12 is of hexagonal cross-section, and thus the spring 33 and balls 32, by engagement with the interior of the housing part 12, constitute a detent mechanism defining potentially six stable angular positions of the rotor body 23 about the longitudinal axis of the housing part 12. It will be recognised that the stable positions of the rotor body 23 are determined by the balls 32 engaging in the corners of the hexagon defined by the interior of the housing part 12. However, it is desired that the rotor body 23 shall have only 180° of rotational freedom within the housing part 12, that is to say will have only four stable angular positions.

In order to restrict the rotation of the rotor body 23 to a maximum of 180° there is provided a metal stop plate 34 which locates within the housing part 12, and through which an axially extending projection (not shown) of the rotor body 23 extends. The stop plate 34 is best seen in Figure 7 from which it can be seen that the stop plate 34 is of hexagonal form so as to be non-rotatable within the housing part 12. The plate 34 is pierced to define an aperture 35 having a pair of stop surfaces 36 spaced apart by slightly greater than 180°. The projection of the rotor body 23 can cooperate with the stop surfaces 36, and the angular extent of the projection of the rotor body 23 is equal to the amount by which the angular spacing between the stop surfaces 36 exceeds 180°. Thus starting at a position where one face of the projection of the rotor body 23 engages one of the stop surfaces 36, then the rotor body 23 can be rotated through 180° to engage the

opposite face of the projection of the rotor body 23 with the other stop surface 36. Moreover, it will be recognised that the positioning of the projection on the rotor body 23 is angularly related to the axis of the bore 31 such that when one face of the projection engages one of the stop surfaces 36 then the balls 32 are engaged in corners of the hexagonal interior of the housing part 12.

Disposed intermediate the stop plate 34 and the inner face of the flange 17 of the housing part 12 are a drive plate 37 and a locking member 38. The drive plate 37 and locking member 38 are, for convenience, formed as separate components, but in operation they move as a single component. The drive plate 37 is moulded in synthetic resin material, and is formed with a circular aperture 39 through which the shaft 24 extends with clearance. Concentric with the aperture 39 the drive plate 37 is formed with an arcuate slot 41 subtending an angle of slightly more than 120°. The projection of the rotor body 23 which cooperates with the stop plate 34 also cooperates with the ends of the arcuate slot 41, and thus the amount by which the angular extent of the slot 41 exceeds 120° is determined by the angular extent of the projection of the rotor body 23. Additionally, radially aligned with the mid point of the slot 41, the outer periphery of the plate 37 is formed with an integral, resilient projection 42. At opposite ends of the slot 31 the plate 37 includes a pair of diametrically opposed, integral, axially extending pegs 43.

The locking member 38 is formed from metal sheet, and comprises a disc like portion 44 having a central aperture 45 through which the shaft 24 extends with clearance. Projecting radially from the disc-like portion 44 is an integral cranked leg 46 the free end

region of which extends in the same direction as, and parallel to, the root portion connected to the disc like portion 44. Moreover, the portion 44 of the member 38 has a pair of diametrically opposed holes 47 in which the pegs 43 of the drive plate 37 are received so as to link the drive plate and the locking member for movement as a single component.

The face of the rotor body 23 presented to the base member 19 is formed with a recess 48 within which is received an H shaped electrical contact member 49. The contact member 49 is constrained by the walls of the recess 48 to move with the rotor body 23, and a compression spring 51 urges the contact member 49 towards the base member 19. The fixed contacts 22 exposed on the inner surface of the base member 19 include a centrally disposed contact which is permanently engaged by one limb of the contact member 49, and an arcuate row of contacts concentric with the centre contact, and engagable by the opposite limb of the contact member 49 as the rotor body 23 moves angularly relative to the base member 19. Naturally a predetermined relationship exits between the arcuate row of contacts 22 and the detent positions of the body 23 relative to the housing part 12.

Conveniently the operating key can only be introduced, and removed, from the housing part 11 when the shaft 24 and rotor body 23 are in one of the two angular limit positions defined by the stop plate 34. Let us assume therefore that the key can be introduced in the counter-clockwise limit position, in which position the projection of the rotor body 23 will be engaged with the left hand stop surface 36 of the stop plate (in Figure 7) and will also be engaged with the left hand end of the slot 41 in the drive plate 37. This position of the rotor body 23 is a detent

position, and rotation of the key through 60° in a clockwise direction will move the rotor body 23 to the next detent position. One limb of the contact member 49 will thus sweep through a 60° arc of the inner surface of the base member 19 and, dependent upon the applicaton of the electrical switch, may move from a position in which it does not engage a fixed contact to a position in which it does engage a fixed contact and thus completes an electrical circuit. During this 60° of movement the projection of the rotor body 23 will be moving within the arcuate slot 41 of the drive plate 37 and thus the drive plate 37 and the locking member 38 will not move angularly relative to the housing part 12. Any tendancy for the drive plate 37 and the locking member 38 to move either through vibration, or as a result of drag upon the shaft 24 will be resisted by the projection 42 engaging in a corner of the hexagonal interior of the housing part 12.

A further 60° of rotation of the key will move the rotor body 23 to its next detended position (its third angular position) naturally causing the contact member 49 to sweep a further 60° of the base member 19. The projection of the rotor member 23 will now lie in contact with the right hand end of the slot 41 of the drive plate 37 so that the subsequent, and final 60° of rotation of the key in a clockwise direction will cause the rotor member 23 to carry to drive plate 37 and thus the locking member 38 with it. The leg 46 of the locking member 38 protrudes through a slot in the wall of the housing part 12, the length of the slot being sufficient to accommodate 60° of rotation of the locking member 38.

In moving from the third to the fourth detented position the projection of the rotor body 23 is in engagement with the end of the arcuate slot 41 of the

drive plate 37. Thus, during subsequent counter-clockwise rotation of the key to turn the rotor body 23 back from its fourth to its first angular position it will be appreciated that during movement from the fourth to the third, and from the third to the second angular positions of the rotor body 23 there will be no accompanying movement of the drive plate 37 and locking member 38. It is only during movement from the second to the first position that the projection of the rotor body 23 will engage the opposite end of the arcuate slot 41 and so cause the drive plate 37 and the locking member 38 to be returned to their original angular positions. Moreover, the movement of the drive plate 37 during movement of the rotor body from its third, to its fourth angular position moves the projection 42 of the drive plate from one corner of the hexagonal interior of the housing part 12 to the next adjacent corner and thus in both permitted angular positions of the drive plate 37 the projection 42 in conjunction with the hexagonal shaping of the interior of the body part 12 performs a detent action. The projection 42 can move as necessary by flexure of the wall of the slot 41.

It will be recognised that the positioning of the arcuate row of fixed contacts 22 will be chosen in relation to the application for which the switch is intended. Similarly, the mechanical locking function performed by the limb 46 of the locking member 38 will be determined by the chosen application. For example, the limb 46 may be moved to a position in which it physically locks a disc drive of a computer so that either a disc may be permanently retained therein, or alternatively the drive is locked against authorised introduction of a disc. The electrical switching action which accompanys operation of the key to move the locking member 38 may also control other functions

of the computer. However, it is to be understood that the combined electrical switch and locking mechanism is not restricted to use in a computer.

In use the assembly will be mounted on a control panel or the like by introducing the housing part 11 through an aperture in the panel so that the flange 13 seats against one face of the panel and a locking nut 31a (Figure 2) can be engaged with the thread 14 and then tightened against the undersurface of the panel. Thereafter the housing part 12 is presented to the rear end of the housing part 11 so that the projecting shaft 24 enters the housing part 11 and the housing part 12 is pressed axially towards the housing part 11 to snap engage the arms 18 with the lugs 16 so interconnecting the parts 11, 12 to define the assembly. It will be understood that the use of the two self-contained units (the housing part 11 containing the key operated mechanism and the housing part 12 containing the locking member 38 and the electrical switch) facilitates fixing of the assembly to a panel by way of nut 13a and flange 13 since it permits the fixing of the housing part 11 prior to engagement therewith of the housing part 12 from which the leg 46 protrudes.

In some applications it may be acceptable for the locking member 38 to be formed from synthetic resin material, in which case it may be expedient to mould the drive plate 37 and the locking member 38 as a single component.

CLAIMS.

1. An assembly of a key operated electrical switch and a locking mechanism comprising a relatively fixed body, a rotor rotatable relative to the body through a predetermined angular distance by means of a key introduced, in use, into a key operated mechanism of the assembly, electrical contacts operable by rotation of the rotor relative to the body, and a locking member protruding from the body, the locking member being movable angularly relative to the body about the axis of rotation of said rotor, and there being a lost motion coupling between the rotor and the locking member whereby the rotor can be moved through a predetermined angular distance relative to the body, and relative to the locking member, whereafter, the locking member moves with the rotor.

2. An assembly as claimed in claim 1 wherein said locking member includes a portion disposed between the key operated mechanism and said rotor.

3. An assembly as claimed in claim 2 wherein a drive shaft coupling said key operated mechanism to said rotor passes through a clearance aperture in said portion of said locking member.

4. An assembly as claimed in anyone of claims 1 to 3 wherein said lost motion coupling comprises a projection on said rotor engagable with a closed end of an arcuate slot in said locking member.

5. An assembly as claimed in anyone of the preceding claims wherein the interior periphery of the body is polygonal in transverse cross section, the rotor carries at least one element resiliently biased outwardly into engagement with the inner periphery of

the body, and said element and the corners of the internal profile of the body constitute a detent mechanism defining stable angular positions of the rotor relative to the body.

6. An assembly as claimed in claim 5 wherein said locking member includes an element resiliently biased outwardly into contact with the interior periphery of the body to constitute a detent means defining stable angular positions of the locking member relative to the body.

7. An assembly as claimed in anyone of the preceding claims wherein said key operated mechanism is an axial pin type key operated locking mechanism.

8. An assembly as claimed in anyone of the preceding claims wherein the key operated locking mechansim and the rotary electrical switch mechanism have separately formed housing parts which are interconnected after introduction of the locking member therebetween.

9. An assembly of a key operated electrical switch and a locking mechanism substantially as hereinbefore described with reference to the accompanying drawings.

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